Friendship Network Quality and Structure and Adolescent Sexual Behavior

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ABTRACT

During adolescent sexual relationships emerge and become normative. Friends come to the fore in explaining the onset, number, and quality of sexual relationships. Prior research has focused on behavior at the individual and couple level. The purpose of this study was to further understanding by examining how friendship networks are related to number of sexual partners. Network analysis allows one to simultaneously explore number and gender of friends, network centrality, closeness, network density, and the friend's sexual behavior, all of which have the potential to enhance understanding of the number of sexual relationships along with information that helps evaluate the quality and safety of such relationships. Five friendship network profiles were observed that separate individuals by number of partners. Variations in combinations of strong and weak ties along with friends' sexual activities, socioeconomic background, family structure, and the age of the adolescent differentiated these profiles from one another.

INTRODUCTION

The initiation of sexual relationships with the opposite gender is a key aspect of development that occurs during adolescence (Dunphy 1963; Dahl 2004; Steinberg 2004). Although much attention has been given to the role of parents in adolescent development, research suggests parents and pubertal development have a modest impact on the frequency of sexual intercourse among males and limited impact among females (Davis et al. 2001; Katachadourian 1990). The lack of association occurs because adolescent peers take the place of parents as the context within which behavior is learned and developed.

Research has examined the role of adolescent friendship networks and delinquency (Regnerus 2002; Maxwell 2002; Warr 1993; Aseltine 1995), age at first sex (Udry et al. 1987), and attitudes concerning premarital pregnancy and abortion (Brazzell et al. 1988). Most studies that focus on friendships, however, have limitations. Some research relies on a single friendship measure such as intimacy (Giordano et al. 1998) or time spent with friends (Zimmer-Gembech 1999). Other studies focus on the structure of peer networks but fail to simultaneously examine the quality of the friendships between network members (Ueno 2005). In contrast to many studies that explore risky sexual behavior (e.g., early age at first sex, unprotected sex), we focus on normative adolescent transition to sexual relationships, only some of which may entail risks. Although they note the influence of friends, studies of sexual activity often focus on processes at the individual or couple level. However, in adolescence, the friendship network has a potentially large influence in establishing normative sexual behavior and providing access to sexual partners, given that the selection of particular sexual partners, for example, is often based on

approval from peers (Collins 2003). In addition, few studies address number of sexual partners as the dependent variable; those that do fail to account for the influence of friendship network structure and quality (Davis et al. 2001; Santelli et al. 1998). Studying number of sexual partners is crucial because it is related to healthy relationship development, as well as risk behaviors that result in HIV or STD's (Valois et al. 1999).

This study focuses on how eight dimensions of friendship networks are associated with the individual's number of sexual partners. The friendship variables to be explored are: number of male friends, number of female friends, closeness of male friends, closeness of female friends, and the number of sexual partners male and female friends have, friendship network density (extent to which the individual's nominations and the ties between those he/she nominates are reciprocated) and centrality (the number of ties the individual has relative to the potential number of ties the individual could have). These friendship dimensions are combined into clusters that go to make up five friendship profiles that are linked to different levels of individual sexual behavior.

School is the primary context where adolescent friendships form and develop. This study defines the network as the set of relationships present at the school level. This setting has the advantage of having nearly complete network data that allows the examination of the link between normative friendship network patterns and number of sexual partners. The first goal of the study is to use the eight measures of network properties to construct friendship networks that are associated with differential levels of sexual intercourse. The second goal is to translate these clusters into profiles that are systematically linked the number of sexual partners and constitute potentially healthy or risky social environment

Friendship Nomination and Gender Considerations

The direction of nomination ties is an important consideration in defining an individual's network. Sent ties indicate a relationship that is chosen by the individual where the level of friendship closeness and number of sexual partners of the friend are important to the respondent. On other measures such as number of friends, centrality, and density, both sent and received ties are important because they measure access to potential sexual partners and social skills.

Having only same-sex friends has different implications for network structure and influence than having friends of both genders. Ties to the opposite gender may provide important socialization with respect forming romantic relationships and may constitute an accessible pool of potential sexual partners that same-sex ties do not. Also, because opposite-sex friendship closeness and sexual behavior of the opposite-gender friend is not relevant to people having only same sex friends, friendship network types were created separately by gender and by whether or not an individual's network included members of the opposite gender. Later, in creating profiles of friendship networks, we find it informative to combine some of the networks that were derived separately by gender and presence of opposite sex members.

Strong and Weak Ties

The difference between strong and weak ties is a key concept for understanding the structure of friendship networks and their influence. Granovetter (1983) defines weak ties as acquaintances that are less socially involved than close friends, which are strong ties. The existence of weak ties facilitates the flow of information in a large network, as people from smaller networks communicate with the larger network. Without these, the overall network would be fragmented and disjointed. Strong ties, on the other hand, strong ties exert more influence over each other and provide opportunities to learn attitudes and behavior that are important in establishing sexual relationships.

Operationalizing Weak Ties

Number of friends and centrality (total number of ties the individual has relative to the potential number of ties they could acquire) are the qualities of friendship used to define the extent of weak ties. The greater the number of friends indicates better social skills (Gest et al. 2001) and access to information and other resources that are potentially important in negotiating a greater number sexual relationships. Also, the greater skills and resources obtained as a result of these ties mean that those with higher numbers of friends have greater social status (Lin et al. 1981) which may make them more attractive to members of the opposite sex than individuals with fewer friends.

Network centrality is assessed using the Bonacich method (1987), a measure of the total number of ties the individual has relative to the potential number of ties in the whole school. In addition, an individual's status, as indicated by the number of ties an individual has, is also linked to the status of the people to whom he/she is connected to (see the illustration of centrality shown in Figure 1). This measure is based on number of sent and received ties, as well as the number of ties the friends have. People with higher centrality have higher-rank within the network hierarchy (Ueno 2004). High centrality may indicate access to a larger number of potential sexual partners.

Operationalizing Strong Ties

Strong ties are measured by the combination of two friendship characteristics: friendship closeness and high network density (a high proportion of mutual nominations). Friendship closeness assesses the amount of time the individual spends with each friend in various settings (home, outside the home, weekends) and the frequency and content of conversation (e.g. talking about problems). Closeness results in: 1) friends having more influence in determining each

other's sexual preferences and 2) individuals choosing a network of friends who have (or desire to have) similar levels of sexual activity. Although weak ties are associated with more potential sexual partners, the influence of a strong tie to a friend with few sexual relationships may offset the impact of weak ties. On the other hand, having close friends is also an indication of good inter-personal skills, which could facilitate establishing relationships with potential sexual partners. This effect may vary by gender. Because females value intimacy, males who are able to establish close relationships with the opposite-sex may have higher numbers of sexual partners than those who cannot do so.

Density is measured by the number of friends that the individual nominates who also nominate each other and the respondent divided by the total number of possible ties in that friendship network (see the illustration of density in Figure 1). High density is usually characterized by homogeneity of beliefs and behavior among the network members. This is a different dimension of strong ties than closeness, where influence occurs through intimacy and time spent with a friend. If no one in a dense network of friends has a high number of sexual relationships, high sexual activity will not be considered normative and the individual will be less inclined to establish sexual relationships. On the other hand, individuals in high-density networks whose members have sexual partners may be more to likely to replicate such behavior.

In sum, weak ties provide access to more potential sexual partners and an awareness of a wider array of acceptable sexual behavior while strong ties establish pertinent knowledge and skills along with a set of norms that affect individual sexual behavior. Some people have both strong and weak ties. They are part of a close dense network that is centrally located in a large network.

Friends Sexual Behavior

Key to understanding how strong and weak ties may influence network members to be engaged in sexual relationships is the sexual behavior of the other network members. Individuals in networks with same sex members actively involved in sexual relationships increases the odds of the person also engaging in sexual relationships. If the network includes a member of the opposite sex, it may further increase the odds having a sexual relationship. The mechanism at work is probably gaining knowledge on how to establish romantic relationships. If the opposite sex member is also engage in a sexual relationship, the odds may be even greater that the individual will become so involved, not necessarily with that person but with that person's colleagues who are sexually active. The relative strength of these pathways to sexual relationships will be examined.

Gender Differences

The influence of strong and weak ties and sexual relationships of network members often differs by gender. Females tend to have larger networks and greater numbers of opposite-sex friends than males (Connolly et al. 2004). In addition, females tend to have better interpersonal skills and value intimacy more than boys (Feiring 1999). This may mean friendship networks involving the opposite sex may be crucial to learning how to begin sexual relationships. However, this may differ by gender. Whereas a male with high numbers of sexual relationships may be termed a 'stud', a female would be a 'slut'. Females may be hesitant to enter sexual relations with males with whom they do not feel intimate. Males, on the other hand who are able to establish high friendship closeness with the opposite sex may have social skills that lead to a high numbers of sexual partners.

Individual and Household Characteristics

From a developmental perspective, age plays an important role in determining number of sexual partners. Pubertal development advances with age as does the acquisition of social skills, shifting from same-sex to mixed-gender friendship networks, and increased sexual experimentation. For this reason age is an important variable to include in the analysis.

Family structure and parental income and education are also important factors that are associated with sexual behavior in adolescence. For example, parental divorce is associated with more sexual activity among offspring (Booth et al. 1984). Not living with both biological parents is related to earlier onset of sexual activity (Flewelling et al. 1990; Newcomber et al. 1987). Greater parental education is associated with less sexual intercourse (Santelli et al. 2000). The study includes controls for age, parental income and education, and family structure in order to clarify the link between friendship network profiles and number of sexual partners.

Links Between Friendship Networks and Sexual Behavior

From the mechanisms discussed, the following propositions are examined concerning how various aspects of friendship networks influence the adolescent's number of sexual partners:

1. Number of sexual partners of the friends will be positively related to the sexual activity of the respondent and having opposite sex-friends.
2. Because both strong and weak ties are indications of good social skills, they will be correlated.
3. These trends may differ by gender; males who have high closeness to females will have higher numbers of sexual partners. On the other hand, females who are close to males may not necessarily have higher numbers of sexual partners.
4. When strong ties are present, respondents will follow the sexual behavior of their friends.
5. Weak ties should be associated with higher numbers of sexual partners.

6. Age, low SES, and not living with both biological parents will be positively related to sexual activity.

DATA

Data from the Wave 1 home questionnaire of the National Longitudinal Study of Adolescent Health (Add Health) was used. Add Health is a nationally representative survey of approximately 20,000 7^{th} to 12^{th} graders that were nested within 132 randomly selected schools in 1995. The saturated sample is a special sub-sample of Add Health consisting of 16 schools where attempts were made to administer in-home questionnaires to all students on the school roster in order to have complete data on friendship networks within a school (N=3,506). The sixteen schools include two large and fourteen smaller ones. Two schools were eliminated from the final sample because of coding errors. In addition, a special education school and a catholic school were eliminated from the sample to reduce potential bias factors. The influence of peers and number of sexual partners may function in different ways in these schools due to disabilities or religiosity. For a small sub-sample of cases (N=86) the friendship data was not collected due to interviewer error. An additional 480 respondents were not included in the sample because they were asked to nominate one friend of each gender instead of five. In this study, only heterosexual relationships are examined because the number of cases that fall outside this specification is too small to study (N<50).

Two additional types of respondents were eliminated from the study. People with no friendship ties fall outside the scope of this study because friendship quality and structure has no bearing on these individuals' sexual behavior (285 males and 262 females). In addition, respondents who have only opposite-sex friends are also excluded from the study. They represent

small (8%) and unrepresentative portion of the population. The final sample consists of 2,063 respondents.

The in-home questionnaire asked each respondent to nominate up to five male and five female friends, for a maximum of ten friends, by identifying them on the school roster. Thus, respondent and friend's ID's were matched up, as well as their respective data. In this way, direct measures of friends' sexual behavior, as well as the friendship network structure of the school, can be constructed. Although adolescents were allowed to have out of school nominations, no data was collected for these friends. However, previous research indicates that out-of school nominations are not very common (Haynie 2003; Ueno 2004) and that most adolescent friendships occur within the school environment (Coleman 1961).

MEASURES

Dependent Variable

Number of sexual relationships: All respondents were asked: "Not counting the people you have described as romantic relationships, have you ever had a sexual relationship with anyone?" Subsequently, respondents who had at least one non-romantic relationship were asked: "With how many people, in total, including romantic relationship partners, have you ever had a sexual relationship? (If you don't remember exactly, please estimate the number of these people.)" These two questions provide an estimated number of sexual partners for those who have ever had a non-romantic sexual relationship (see table 1 for descriptives).

A different series of questions was asked respondents who only had sexual activity within a romantic relationship. For up to three romantic relationships, respondents are asked of each whether they: "touched each other with no clothes on", "had sexual intercourse", and/or "touched each others genitals". Because a non-romantic sexual relationship was never defined as

intercourse, for romantic partners we define the relationship as sexual if they had ever done any of these three. Although it is a shortcoming of this study that only three romantic relationships were included in this line of questioning, few respondent indicate having a third romantic relationship, which should make the number of romantic relationships missed negligible. The final scale combining romantic and non-romantic relationships was recoded to range from 0 to 10 or more partners because the majority of the cases fell in this range (95%). The mean number of sexual partners is 1.35, with a standard deviation of 2.25. A categorical variable was utilized in supplemental analysis to test whether there were significant differences between people with no sexual partners, people with 1-2 sexual relationships or people with many sexual partners (3 or more). The results were similar to those obtained with the continuous variable.

Independent Variables

Network Size is a count of the number of people the person nominates and is nominated by. Sent and received ties were included because both provide the respondent with links to other people who can influence his or her behavior or provide contact with potential sexual partners. The range of this variable is from 0 to 13. The mean sent and received ties to male friends is 2.91 (Std. Dev=2.02) and to females is 2.93 (Std. Dev=2.12). *Friendship closeness* is a scale based on five dichotomous (0=no, 1=yes) questions asked about each friend the respondent nominates addressing whether they: 1) went to their house this week, 2) hung out or went somewhere together, 3) talked about a problem, 4) talked on the telephone, or 5) spent time with the friend during the weekend. Factor analysis reveals that these five items represent a unidimensional construct with a reliability coefficient of .68. Items were summed to construct a friendship closeness scale for each friend ranging from 0=no closeness to 5=very close. The mean across

closeness for all friends of the same gender was taken to calculate summary measures of male and female closeness (see table 1 for descriptives).

Many studies have noted the inaccuracy of respondent's reports of friend's behavior (e.g. Haynie 2001). A strength of this study is the availability of *friend's self-reported sexual behavior*. Dichotomous variables were created: presence of a male or female friend who has had three or more sexual partners (coded as 0-no such friend, 1-friend with 3 or more sexual relationships).

Density is measured by the number of friends that the respondent nominates who also nominate each other as friends and reciprocate the tie to the respondent, divided by the total number of possible ties in that friendship network. Thus, a person who nominates three friends where there is a reciprocal tie between two of these friends and all friends reciprocate the individual's nomination would have a density of .56. Ties that friends have to people outside the respondent's immediate friendship network are ignored when calculating density. Network *centrality* is measured using Bonacich eigenvector centrality (1987), which is a measure of the number of people to whom a respondent is connected based on the size of the individual's and his friend's networks.

The controls used for this study are age, parent's education, income per capita, and family structure. *Age* is measured at the time of the interview. Controlling for age takes into account the expansion of the number of friends, development of better social skills, and increase in sexual partners that are a normal part of the developmental process for this age range. *Parent's education* ranges from 1 – no school to 9 – received professional training beyond a 4-year college or university. *Income per capita* is ranges from 0 to 100,000 with a mean of 15,110 and a standard deviation of 11,030. These measures are included to remove any bias that may result

from differing friendship patterns and number of sexual partners by levels of SES (Miller et al. 2001). *Family structure* is coded as 0 = two biological parents, 1 = other family structure. Preliminary analysis that distinguished between single parents, step-parents, and other family types found they worked in similar ways. Although certain studies find little or no relationship between family type and sexual behavior (e.g. Davis et al., 2001), some research indicates that adolescents who do not live with both biological parents engage in more sexual behavior than those who do (Wright Young et al., 1991). Exploratory analysis controlling for race indicated that its inclusion had no effect on substantive findings and was dropped from the study as a control variable.

Only respondents that had complete data on all friendship characteristics were included in the final sample because cluster analysis could not be conducted on multiple imputed datasets. Fewer than 5% of the values were missing for any of the control variables except parental education and per capita household income. For these two variables, approximately 25% of the data were missing because, although attempts were made, various households did not complete the parental questionnaire. Missing cases were replaced using multiple imputation (ICE) in STATA.

Analysis

Analysis taking a variable centered approach indicated that linear regression (e.g. negative binomial regression) failed to pick up on the complexity of how friendship variables combine to estimate number of sexual partners. A person centered analysis using two-step clustering (SPSS) was effective in constructing combinations of friendship variables into networks that are linked to respondent's number of sexual partners.

Separate cluster analyses were undertaken for (1) males with male friends only, (2) males with male and female friends, (3) females with female friends only, and (4) females with female and male friends. A preliminary number of clusters were established by using Bayesian Information Criteria. Subsequently, this number is refined by employing a distance matrix to calculate which set of clusters are most different from each other. The balance between these two measures specifies the final number of clusters. This is an advantage over other methods such as hierarchical or k-means clustering, where the user subjectively decides the number of existent clusters. Initial results indicate five cluster solutions for respondents with same-sex friends and four cluster solutions for respondents with friends of both genders. Alternative solutions that constrained all categories to four or five cluster solutions were explored in order to make the results consistent across respondents. In the end, the four cluster solution provides the most consistent and interpretable results across friendship categories.

The data were then exported to STATA in order to make use of the weights provided by Add Health. For each cluster descriptive statistics of the respondent's number of sexual partners and his or her demographic (age, parental income and education, and family structure) characteristics were obtained. By examining these statistics, links between the respondent's number of sexual partners and friendship clusters can be specified. Finally, ANOVA (for continuous variables such as age) and Chi-Square (for dichotomous variables such as family structure) tests were conducted to examine whether the clusters differ significantly in the number of sexual partners and demographic characteristics. These tests were conducted with and without controls using ANCOVA. In addition, regressions with dummy variables for each cluster reveal which ones are significantly different from one another in predicting number of sexual partners.

Once the four networks had been derived for each of the four categories (gender by opposite sex network member), they were evaluated for possible combinations based on shared weak ties, strong ties, friend's involvement in sexual relationships, respondent's sexual behavior, and the other variables. Five friendship profiles emerged from this analysis.

RESULTS

The four sets of networks for (1) males with males with male friends only, (2) males with male and female friends, (3) females with female friends only, and (4) females with female and male friends appear in Tables 2, 3, 4, and 5 respectively. Cross-network analysis reveals similar networks of individuals that are combined into network profiles. Five profiles involving up to four networks each were identified and are shown in Table 6. They are termed *modestly social-sexually inactive, modestly social-sexually active, strong ties-sexually active, strong and weak ties- moderately sexually active,* and *strong and weak ties-sexually active.* Each profile includes both male and female networks.

The first network profile (*modestly social-sexually inactive*) is comprised of networks B, E, I, and M that appear in Tables 2, 3, 4, and 5 respectively. Network B for males with same-sex friends reveals that all friendship characteristics are low. That is, the network is characterized by an absence of strong (closeness and density) and weak (number of friends and centrality) ties and having friends who have only 1, 2, or no sexual partners. Networks E, I, and M have the same characteristics. The adolescents in this profile tend to be younger than those in other profiles, and have parents who are in the mid-range of socioeconomic status and in intact marriages. Given their youthfulness, the modest levels of social involvement of these adolescents may reflect inexperience but could reflect problems forming friendship ties among some people. Respondents who fit this profile comprise 30% of all males and 42% of all females. Assuming

the adolescents in this profile shift to higher levels of sociability, this is probably a healthy network profile of which to be a part.

The *modestly social-sexually active* friendship profile consists of networks J, L, O, and P found in Tables 4 and 5 respectively. This profile consists of individuals who have both male and female friends who also have very low levels of both strong and weak ties, although the females in the group tend to be moderately close to a few males. Relationally, what most separates individuals in this profile from the previous one is that they have a few sexually active male and, to a somewhat lesser extent, female members in their networks. Their own sexual activity is in the highest categories. The tendency to have mean or high levels of closeness to a few sexually active members of the opposite sex without the existence of close same-sex friendships may indicate the existence of an unhealthy friendship group. Females in this profile may be engaging in high numbers of sexual relationships in order to maintain their relationship with their current male friends or so they can attract other males. Demographically they are older adolescents who come from families with modest incomes and levels of educational achievement. Also, the chances are quite high that, for all or some part of their youth, they did not grow up with two biological parents. Given the very limited social resources, the *modestly social-sexually active* may be the least healthy network profile of which to be a part. The lack of strong ties means that relations may be more superficial, unsatisfactory, and susceptible to violence and infidelity. Growing up without two biological parents and in a low socioeconomic home (Miller et al. 2001) may mean that the level of sexual behavior manifested may already be a permanent part of the individual's repertory. This profile includes 26% of all males and 23% of all females.

The *strong ties-sexually active* profile consists of networks C and H found in Tables 1 and 2 respectively. The profile consists of males and females who have same sex friends only. Weak ties are at very low levels and their strong ties are at mid-levels. Their friends have many sexual relationships and their own sexual behavior matches that of their friends. They are older than individuals in any of the other profiles and they have parents with modest educational and occupational achievements. The males, unlike the females, are much more likely to have grown up in a two parent families. In all likelihood the high levels of sexual behavior of their friends and their advanced age contribute to their high levels of sexual behavior reported. Given that the strong ties are at a moderate level and that the males grew up in two biological parent homes we reason that relationships are moderately satisfactory and healthy. This profile includes 11% of all males and 6% of all females.

The *strong and weak ties-moderately sexually active* profile consists of networks A, F, and K shown Tables 1, 2, and 3 respectively. The profile consists of males and females who have same sex friends only and males who have both male and female friends. Overall weak ties tend to be high. The only exception is males with male friends only whose centrality is medium. High levels of strong ties characterize all three networks. The number of friends who have high levels of sexual relationships tends to be low, although males who have both males and female friends report medium levels of friends who are sexually very active. In this profile individuals with same sex friends have low levels of sexual activity while the males with both male and female friends have moderate levels of sexual activity. Demographically, the respondents in this profile tend to be in younger except for those who have friends of both genders. Their parents tended to have mid to high levels of socioeconomic achievement and the children grew up with two biological parents. The males with both male and female friends (Network K) tend to be

somewhat more sexually active than those with same gender friends. This trend may be reflecting developmental differences or the ability to establish a close friendship with a member of the opposite sex. These individuals tend to be older than those with same sex friends only. Overall, the high level of social integration found in all three networks makes this a healthy friendship network profile. This profile includes 29% of all males and 16% of all females.

The *strong and weak ties-sexually active* profile consists of networks D, G, and N shown in Tables 1. 2. and 4 respectively. The profile consists of males and females who have same sex friends only and females who have both male and female friends. Both weak and strong ties are consistently strong in these networks and the level of friends' sexual behavior is high. The level of sexual relationships is high among males with male friends only and females with female friends only, but is somewhat lower among females who have same and opposite sex friends. Demographically these adolescents tend to be older and have families whose income is lower and, with the exception of women with both male and female friends, have low levels of educational achievement. Also, males and females with same sex friends are more likely to have experienced a home without two biological parents whereas females with friends of both genders are more likely to have grown up with two biological parents. The evidence would suggest the network profile is in the mid range of a health environment for the development of intimate relationships.

The finding that females with friends of both genders (Network N), unlike those with same sex friends, have moderate levels of sexual activity is of interest. Based on the high numbers of weak ties and friends who are sexually active we would expect a higher level of sexual relationships. One interpretation is that these females have established close relationships with males and do not feel the need to engage in sexual relations with them in order to have them

as friends. A comparison of these females to the network of male with strong and weak ties and sexually active friends (Network K) substantiates a gender difference in the association between friendship closeness to the opposite sex and number of sexual partners. The ability of males to establish close relationships with members of the opposite-sex (who value intimacy) may be associated with females being more willing to engage in sexual activity. In contrast, females who are able to form close friendships with males do not feel the need to engage in sexual activity in order to secure those friendships. Both of these profiles may be healthy in that they are able to establish intimate relationships. This profile includes 4% of all males and 12% of all females.

An examination of friendship patterns across the five profiles (as shown in Table 6) reveals a number of consistent patterns. First, the number of sexually active friends is a very strong predictor of number of sexual relationships. Second, having opposite-sex friends that are sexually active is related to higher numbers of sexual partners for the respondent when friendship closeness is low. Third, there appears to be important gender differences in the transition to active an active sexual life among those with friends of both genders and closeness to the opposite-sex. Females with high closeness to males have mean numbers of sexual partners and males who are close to females indicate high numbers of sexual relationships. Fourth, the number of strong ties is highly related to the number of weak ties. In no instance is there large number of weak ties without significant numbers of strong ties indicating that the skills associated with the development of strong ties are important for the generation of weak ties. Fifth, the combination of many strong ties and a significant number of sexual active friends is likely to be a good predictor of number of sex partners and may provide a healthy environment for the development of satisfactory relationships (see Table 7). Sixth, not surprising is the finding that adolescent age is also a strong predictor of sexual involvement. Sixth, as indicated in prior

research, low parental socioeconomic status and not growing up with two biological parents is positively associated with the number of adolescent sexual relationships.

DISCUSSION AND CONCLUSIONS

Upon reaching adolescent sexual relationships emerge and become normative. Friends come to the fore in explaining the onset, number, and quality of sexual relationships. Prior research has focused on behavior at the individual and couple level. The purpose of this study was to further understand how friendship networks are related to number of sexual partners in adolescence. Network analysis allows one to simultaneously explore number and gender of friends, network centrality, closeness, network density, and the friend's sexual behavior, all of which have the potential to enhance understanding of the number, quality and safety of adolescent sexual relationships. Five friendship network profiles were observed that separate individuals by number of partners and the probable quality and safety of the sexual relationships. Variations in combinations of strong and weak ties along with friends' sexual activities, socioeconomic background, family structure, and the age of the adolescent differentiated these profiles from one another.

Utilizing Granoveter's theory of strong and weak ties, together with developmental and demographic variables, to interpret the mechanisms at work indicates that friendship profiles add significantly to understanding the influence of contextual dimensions on adolescent sexual relationships. For example, if the presence of a sexually active friend in the networks was not accounted for, the two profiles of modestly social respondent's would be grouped together. Thus, the key variable separating sexually active respondents from non-sexually active ones would be missing from the analysis.

Also, by taking friends sexual behavior into account, it is clear that there are two distinct types of respondents who have both strong and weak ties: those with friends who have few sexual partners and those with sexually active friends. This distinction is important because many people would argue that having strong and weak ties is positive, but having many sexual partners negative. Arnett (2000) proposes that identity exploration and marriage postponement until the mid-twenties will be positive in establishing stable relationships in the future. In this way, sexual exploration within the context of a friendship group where both strong and weak ties are present may be positive rather than negative. On the other hand, higher numbers of sexual partners are related to STD's and HIV (Valois et al. 1999).

Studies that use only one measure, such as number of friends or closeness to best friend fail to address the influence other variables. Opposite-sex friendship closeness is not often assessed as a separate friendship dimension that may affect sexual behavior. Findings from this study indicate closeness to the opposite-gender plays different roles for males and females with friends of both genders who have both strong and weak ties – leading males to high numbers of sexual partners and females to maintaining fewer sexual relationships than their friends.

This study has several implications for further research. Because early sexual activity can influence subsequent family formation, it is important to analyze the extent to which friendship profiles in adolescence are related to subsequent transitions to family formation. For example, people in the *modestly social-sexually inactive* profile that do not initiate close friendships or sexual relationships in adolescence may continue this trend into adulthood and find it difficult to establish a stable relationship. Also, respondents in the *modestly social-sexually active* profile may be in and out of multiple relationships once they reach adulthood and unable to form and sustain high quality intimate relationships.

This study would have benefited from having a larger sample of individuals who only nominate opposite-gender friends, which would have made analysis of their friendship profiles possible. Additional information on the nature of the friendship would have helped clarify whether strong ties were exerting influence due to peer pressure, modeling, or selection. For example, an availability of qualitative in-depth interviews may help clarify whether each individual agrees that he or she belongs to the friendship profile suggested by the analysis. Furthermore, a discussion of how the respondents view the dynamics at play in their friendship networks would better inform these findings.

From a policy perspective, two profiles are of concern. Respondents who are in the *modestly social-sexually inactive* profile constitute over one fourth of the respondents in the sample. These people may not be acquiring the skills that will help them navigate life and their sexual decisions in a healthy way. In addition, respondents in the profile with no strong or weak ties to a sexually active male friend (*modestly social-sexually active*) seem unable to form close same-sex relationships. School-wide policies that encourage more interaction between people belonging to different friendship profiles may help these individuals form healthy relationships. In addition, mixed sex activity groups may help these individuals learn how to initiate and maintain healthy relationships with the opposite sex.

The process by which adolescents become sexually active is complex and varies from individual to individual. By combining eight measures of friendship networks and creating five friendship profiles, knowledge regarding the ability to predict the number of adolescent sexual relationships is enhanced. This is the first study (to our knowledge) that examines the extent and balance between strong and weak ties within the individual's friendship network along with whether the network includes an opposite sex member and/or a sexually active member on

adolescent sexual relationships. The friendship network feature of weak ties suggests that social rank and the number of potential partners are important while data on strong ties convey information about the importance of social skills, access to knowledge, and the influence of norms. Findings reveal important gender difference with respect to the opposite sex friendship closeness. The research increases the ability to predict whether or not an individual is sexually active to a greater extent than simply knowing about the sexual behavior of a best friend or whether the individual has a romantic partner. The next step is to estimate the influence of the path by which sexual relations are achieved during adolescence on the quality of cohabiting and marital relationships.

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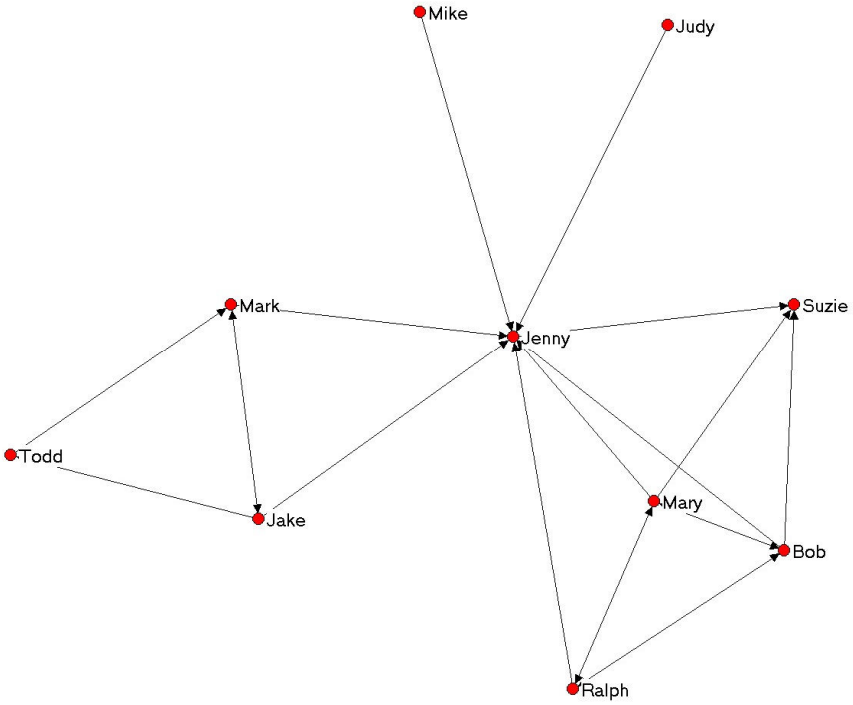
Figure 1. Density and Centrality



CENTRALITY (Weak Ties): In this simulated graph Jenny has the highest centrality because she is tied to many people. Also, she is tied to people who have many connections, such as Bob, Mark or Jake.

DENSITY (Strong Ties): The network that Jenny, Bob, Mary, Suzie and Ralph belong to has high density because there is high interconnection amongst its members.

Table 1. Descriptive Statistics for dependent, independent and control variables.

	Minimum	Maximum	Mean	Std. Deviation
# of Sexual Partners	0	10	1.35	2.25
MF Count	0	12	2.91	2.02
MF Closeness	0	5	2.01	1.39
MF with high # sex part.	0	1	0.37	0.48
FF Count	0	13	2.93	2.12
FF Closeness	0	5	2.25	1.36
FF with high # sex part.	0	1	0.27	0.44
Density	0	1	0.29	0.28
Centrality	0.13	4.50	0.99	0.52
Age	12	20	15.91	1.63
Black	0	1	0.05	0.22
Hispanic	0	1	0.07	0.26
Other	0	1	0.10	0.30
Income Per Capita	0	100	15.11	11.03
Parent Education	0	9	5.69	2.12
Family Structure	0	1	0.33	0.47

Note: MF=Male Friend, FF=Female Friend

Table 2. Cluster Analysis for Males with Male Friends Only.

	Overall Mean	**Network A** Lowest (LT) *Strong & Weak Ties – Moderately Sexually Active*	**B** Low (L) *Modestly Social-Sexually Inactive*	**C** High (H) *Strong Ties – Sexually Active*	**D** Highest (HT) *Strong & Weak Ties – Sexually Active*	Chi-Square/F no controls	Chi-Square/F with controls
Respondent's Number of Sexual Partners	1.274	0.62 (LT)	1.16 (L)	1.92 (H)	2.13 (HT)	6.19*	8.43**
W/controls		H***		LT***			
w/o controls		H**, HT*		LT***	LT*		
Weak Ties							
MF Count	2.73	2.8 (H)	1.67 (LT)	2.58 (L)	5.55 (HT)		
FF Count	0.52	0.47 (M)	0.15 (LT)	0.34 (L)	2.12 (HT)		
Cent/Marg	0.62	0.64 (M)	0.37 (LT)	0.54 (L)	1.44 (HT)		
Strong Ties							
MF Closeness	2.56	2.62 (H)	2.06 (LT)	2.75 (H)	3.09 (HT)		
Density	0.41	0.68 (HT)	0.03 (LT)	0.43 (M)	0.42 (M)		
Friend's Sexual Beh.							
MF with high # sex part.	0.35	0 (LT)	0 (LT)	1 (HT)	0.5 (H)		
Descriptives							
Age	16.02	15.31 (LT)	15.78 (L)	16.79 (H)	16.99 (HT)	3.06	3.68*
Income Per Capita	14.13	15.56 (HT)	13.7 (L)	13.19 (L)	12.12 (LT)	0.27	0.24
Parent Education	5.47	5.54 (H)	5.78 (HT)	5.26 (L)	5.05 (LT)	0.65	0.56
Family Structure (0 = 2 bio parents)	0.35	0.3 (L)	0.5 (HT)	0.28 (LT)	0.45 (H)	5.81	5.64
Number of Cases	405	138	105	120	42		

* p<.05, ** p<.01, ***p<.001

MF=Male Friend, FF=Female Friend

LT = Lowest, L = Low, M = Mean, H = High, HT = Highest (compared to the overall mean)

Chi-Square Analysis was conducted for dichotomous variables (Family structure). One-Way ANOVA was conducted for continuous variables (Age, income, education and respondent's number of sexual partners).

Table 3. Cluster Analysis for Females with Female Friends only

	Overall Mean	**E** Lowest (LT) *Modestly Social – Sexually Inactive*	**F** Low (L) *Strong & Weak Ties – Moderately Sexually Active*	**G** High (H) *Strong & Weak Ties – Sexually Active*	**H** Highest (HT) *Strong Ties – Sexually Active*	Chi-Square/F no controls	Chi-Square/F with controls
Respondent's Number of Sexual Partners	1.54	0.81 (LT)	1.13 (L)	3.03 (H)	3.26 (HT)	43.03***	12.11***
w/controls		HT***			LT***		
w/o controls		HT***	HT**		LT***, L**		
Weak Ties							
MF Count	0.73	0.31 (LT)	0.8 (H)	3.89 (HT)	0.56 (L)		
FF Count	2.62	1.58 (LT)	3.14 (H)	6.26 (HT)	2.62 (M)		
Cent/Marg	0.67	0.39 (LT)	0.81 (H)	1.92 (HT)	0.61 (L)		
Strong Ties							
FF Closeness	2.74	2.49 (LT)	2.86 (H)	3.52 (HT)	2.75 (M)		
Density	0.26	0.01 (LT)	0.47 (HT)	0.43 (H)	0.25 (M)		
Friend's Sexual Beh.							
FF with high # sex part.	0.2	0 (LT)	0 (LT)	0.42 (H)	1 (HT)		
Descriptives							
Age	16	16.36 (H)	15.25 (LT)	16.11 (H)	17.31 (HT)	3.11	3.79*
Income Per Capita	14.26	15.69 (HT)	14.27 (M)	9.61 (LT)	13.24 (L)	1.66	1.03
Parent Education	5.52	5.26 (LT)	5.73 (HT)	5.47 (L)	5.34 (L)	0.58	0.16
Family Structure (0 = 2 bio parents)	0.34	0.28 (LT)	0.29 (L)	0.45 (H)	0.53 (HT)	16.5***	14.48**
Number of Cases	404	149	164	19	72		

* p<.05, ** p<.01, ***p<.001

MF=Male Friend, FF=Female Friend

LT = Lowest, L = Low, M = Mean, H = High, HT = Highest (compared to the overall mean)

Chi-Square Analysis was conducted for dichotomous variables (Family structure). One-Way ANOVA was conducted for continuous variables (Age, income, education and respondent's number of sexual partners).

Table 4. Cluster Analysis for Males with Friends of Both Genders

	Overall Mean	**I** Lowest (LT) *Modestly Social – Sexually Inactive*	**J** High (H1) *Modestly Social – Sexually Active*	**K** High (H2) *Strong & Weak Ties – Moderately Sexually Active*	**L** Highest (HT) *Modestly Social – Sexually Active*	Chi-Square/F no controls	Chi-Square/F with controls
Respondent's Number of Sexual Partners	1.62	0.62 (LT)	1.94 (H)	2.19 (H)	2.2 (HT)	6.59**	7.59**
w/ controls		H1*,H2†, HT**	LT*	LT†	LT**		
w/o controls		H1**, H2*, HT**	LT**	LT*	LT**		
Weak Ties							
MF Count	3.52	2.65 (LT)	3.08 (L)	5.21 (HT)	3.25 (L)		
FF Count	2.93	1.99 (LT)	2.13 (L)	5 (HT)	2.69 (L)		
Cent/Marg	1.17	0.89 (LT)	1.01 (L)	1.8 (HT)	0.98 (L)		
Strong Ties							
MF Closeness	2.52	2.35 (LT)	2.45 (L)	2.92 (HT)	2.38 (L)		
FF Closeness	1.83	1.56 (LT)	1.64 (L)	2.37 (HT)	1.8 (M)		
Density	0.21	0.2 (M)	0.19 (L)	0.26 (HT)	0.18 (LT)		
Friend's Sexual Beh.							
MF with high # sex part.	0.41	0 (LT)	1 (HT)	0.42 (M)	0.45 (H)		
FF with high # sex part.	0.26	0 (LT)	0 (LT)	0.18 (L)	1 (HT)		
Descriptives							
Age	16.03	15.5 (LT)	16.46 (HT)	16.02 (M)	16.43 (H)	9.32***	9.66**
Income Per Capita	16.07	16.66 (H)	15.72 (L)	17.04 (HT)	14.68 (LT)	0.79	1.55
Parent Education	5.87	5.99 (H)	5.05 (LT)	6.3 (HT)	5.85 (M)	4.42*	4.90*
Family Structure (0 = 2 bio parents)	0.36	0.28 (LT)	0.43 (H)	0.31 (L)	0.47 (HT)	4.95	5.71
Number of Cases	655	213	134	166	142		

* p<.05, ** p<.01, ***p<.001

MF=Male Friend, FF=Female Friend

LT = Lowest, L = Low, M = Mean, H = High, HT = Highest (compared to the overall mean)

Chi-Square Analysis was conducted for dichotomous variables (Family structure). One-Way ANOVA was conducted for continuous variables (Age, income, education and respondent's number of sexual partners).

Table 5. Cluster Analysis for Females with Friends of Both Genders

	Overall Mean	**M** Lowest (LT) *Modestly Social – Sexually Inactive*	**N** Mean (M) *Strong & Weak Ties – Sexually Active*	**O** High (H) *Modestly Social – Sexually Active*	**P** Highest (HT) *Modestly Social – Sexually Active*	Chi-Square/F no controls	Chi-Square/F with controls
Respondent's Number of Sexual Partners	1.04	0.61 (LT)	1.06 (M)	1.44 (H)	1.66 (HT)	122.33***	33.60***
w/controls		M*, HT***, H**	LT*, HT†	LT**	LT***, M†		
w/o controls		M*, H***, HT***	LT*, H*, HT*	LT***, M*	LT***, M*		
Weak Ties							
MF Count	3.16	2.44 (L)	6.18 (HT)	2.85 (L)	2.43 (LT)		
FF Count	3.47	2.97 (LT)	5.39 (HT)	3.29 (L)	3.1 (L)		
Cent/Marg	1.19	1.05 (LT)	2.02 (HT)	1.08 (L)	0.92 (LT)		
Strong Ties							
MF Closeness	1.71	1.48 (LT)	2.18 (HT)	1.68 (M)	1.86 (H)		
FF Closeness	2.73	2.56 (LT)	3.33 (HT)	2.64 (L)	2.66 (L)		
Density	0.21	0.23 (M)	0.3 (HT)	0.16 (LT)	0.16 (LT)		
Friend's Sexual Beh.							
MF with high # sex part.	0.39	0 (LT)	0.56 (H)	1 (HT)	0.54 (H)		
FF with high # sex part.	0.27	0 (LT)	0.5 (H)	0 (LT)	1 (HT)		
Descriptives							
Age	15.72	15.22 (LT)	15.98 (H)	15.98 (H)	16.43 (HT)	2.46	2.07
Income Per Capita	14.82	15.95 (HT)	13.18 (LT)	13.95 (L)	14.54 (L)	1.11	2.06
Parent Education	5.72	5.69 (M)	6.22 (HT)	5.55 (L)	5.54 (LT)	2.8	3.64*
Family Structure (0 = 2 bio parents)	0.3	0.23 (LT)	0.26 (L)	0.31 (M)	0.5 (HT)	115.2***	93.33***
Number of Cases	599	270	102	119	108		

* p<.05, ** p<.01, ***p<.001

MF=Male Friend, FF=Female Friend

LT = Lowest, L = Low, M = Mean, H = High, HT = Highest (compared to the overall mean)

Chi-Square Analysis was conducted for dichotomous variables (Family structure). One-Way ANOVA was conducted for continuous variables (Age, income, education and respondent's number of sexual partners).

Table 6. Summary of Features by Friendship Profile (+ = rates high on this characteristic, – = rates low on this characteristic).

	No Weak or Strong Ties		**Presence of Strong and Weak Ties ***		
	Modestly Social – Sexually Inactive	*Modestly Social – Sexually Active*	*Strong Ties – Sexually Active*	*Strong & Weak Ties – Moderately Sexually Active*	*Strong & Weak Ties – Sexually Active*
Networks	B,E,I,M	J,L,O,P	C,H	A,F,K	D,G,N
Weak Ties					
MF Count	–	–	–	+	+
FF Count	–	–	–	+	+
Cent/Marg	–	–	–	+	+
Strong Ties					
MF Closeness	–	– (†)	+	+	+
FF Closeness	–	– (†)	+	+	+
Density	–	–	+	+	+
Friend's Sexual Behavior					
MF with high # sex part.	–	+	+	–	+
FF with high # sex part.	–	Varies	+	–	+
Age	– (†)	+	+	–	+
Income Per Capita	+ (†)	–	–	+	–
Parent Education	+ (†)	– (†)	–	+	– (†)
Family Structure (0=2 bio. Parents)	– (†)	+ (†)	Varies	–	+ (†)
Number of Cases	737	503	192	468	163
Males with Same-Sex Friends	105 (B)	N/A	120 (C)	138 (A)	42 (D)
Females with Same-Sex Friends	149 (E)	N/A	72 (H)	164 (F)	19 (G)
Males with Friends of Both Genders	213 (I)	134 + 142 (J & L)	N/A	166 (K)	N/A
Females with Friends of Both Genders	270 (M)	119 + 108 (O & P)	N/A	N/A	102 (N)

MF=Male Friend, FF=Female Friend

* One profile has only strong ties in the absence of weak ties.

† The demographic characteristics in vary across networks in this friendship profile – the sign in the table represents the tendency of most networks.

Table 7. Health and Unhealthy Sexual Relationship by Friendship Profile

Profile	Percent Male	Percent Female	Healthy Sexual Relationships
Modestly social Sexually inactive	30	42	Few friends and limited sexual behavior may be a function of being very young. The demographics suggest this may be the case. However, the lack of friends may lead many to evolve into the *modestly social-sexually active* profile, an unhealthy friendship environment.
Modestly social Sexually active	26	23	Older adolescents who have not developed strong or weak ties. Significant numbers of the few friends they have are very active sexually. Their limited social skills indicate that their sexual relations may be of poor quality and risky.
Many Strong ties Sexually active	11	6	The abundance of strong ties and significant number who are sexually very active bodes well for high quality sexual relationships. However, the low socioeconomic status of the parents and the tendency toward family instability for some may indicate some risk for poor quality relationships.
Many Strong and Weak ties Moderately Sexually active	29	16	Midlevel strong and weak ties and friends with low levels of sexual relationships characterize this profile. Growing up in middle class homes with two biological parents are part of the package. They are moderately sexually active and represent a healthy, low risk pattern of sexual behavior.
Many Strong and Weak ties Sexually active	17	12	Both weak and strong ties are consistently strong and the level of friends' sexual behavior is high as is the adolescent's sexual behavior. They tend to be older and in homes with mid-levels of socioeconomic status. In this profile females have fewer sexual partners compared to males. Overall, they only at mildly at risk of unhealthy sexual relationships.